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Multivariate Statistical Postprocessing of Ensemble Forcasts of Precipitation and Temperature over four River Basins in California

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Hydrological forecasts strongly rely on predictions of precipitation amounts and temperature as meteorological inputs to hydrological models. Ensemble weather predictions provide a number of different scenarios that reflect the uncertainty about these meteorological inputs, but are often biased and underdispersive, and therefore require statistical postprocessing. In hydrological applications it is crucial that spatial and temporal (i.e. between different forecast lead times) dependencies as well as dependence between the two weather variables is adequately represented by the recalibrated forecasts. We present a study with temperature and precipitation forecasts over four river basins over California that are postprocessed with a variant of the nonhomogeneous Gaussian regression method (Gneiting et al., 2005) and the censored, shifted gamma distribution approach (Scheuerer and Hamill, 2015) respectively. For modelling spatial, temporal and inter-variable dependence we propose a variant of the Schaake Shuffle (Clark et al., 2005) that uses spatio-temporal trajectories of observed temperture and precipitation as a dependence template, and chooses the historic dates in such a way that the divergence between the marginal distributions of these trajectories and the univariate forecast distributions is minimized. For the four river basins considered in our study, this new multivariate modelling technique consistently improves upon the Schaake Shuffle and yields reliable spatio-temporal forecast trajectories of temperature and precipitation that can be used to force hydrological forecast systems.

References:

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